US Army Corps of Engineers

Great Lakes & Ohio River Division

One Team: Relevant, Ready, Responsive and Reliable

Forecast Scenarios for the Ohio River Mainstem Systems Study (ORMSS)

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Topics

- Introduction
- ORMSS Forecasting Models
- Hill Model
- Hill Results
- ORMSS Results
- Conclusions and Recommendations

Introduction - ORMSS

- Interim Feasibilities (2000) - authorized
  - JT Myers & Greenup lock extensions
  - Ecosystem Restoration Program
- Draft System Investment Plan (SIP) & PEIS (May 2006)
  - Proactive maintenance, major rehabs, lock replacements (oldest sites)
  - Schedule of investments for next 50 years
  - Cumulative Effects Assessment

Introduction – Scoping Issues & NAS

- Areas already consistent
  - Systems Analysis
  - Transportation Rates
  - Modeling Lock Congestion
  - Structural Reliability
- Areas where adjustments made to scope
  - Forecasts and Uncertainty
  - Assessments of Nonstructural Alternatives
  - Better Integration of Engineering, Economics and Environmental inputs
  - Sensitivity of Barge Traffic to Rates
  - Ecosystem Sustainability Needs

Introduction - ORS & UMR

Ohio River System

- 260 Mtons
- 60% coal; 60% internal
- Ave haul 400+ miles
- Many destinations
- Market – electric utility
- Year round navigation
- 20 two-chamber projects

Upper Miss River

- 130 Mtons
- 50% grain; 60% outbound
- Ave haul 1,000+ miles
- One dominant destination
- Market – world grain
- Winter little or no traffic
- 25 of 29 projects have single-chambers

Models - Focus on Coal Forecasts

- Future use influenced by
  - Economic growth, demand for electricity
  - Environmental policy
  - International trade – export & imports
- Tools
  - Coal Model developed in LRH & refined by ORNL
  - Potential – work with Hill & Associates to expand their model

Models – the Coal Model

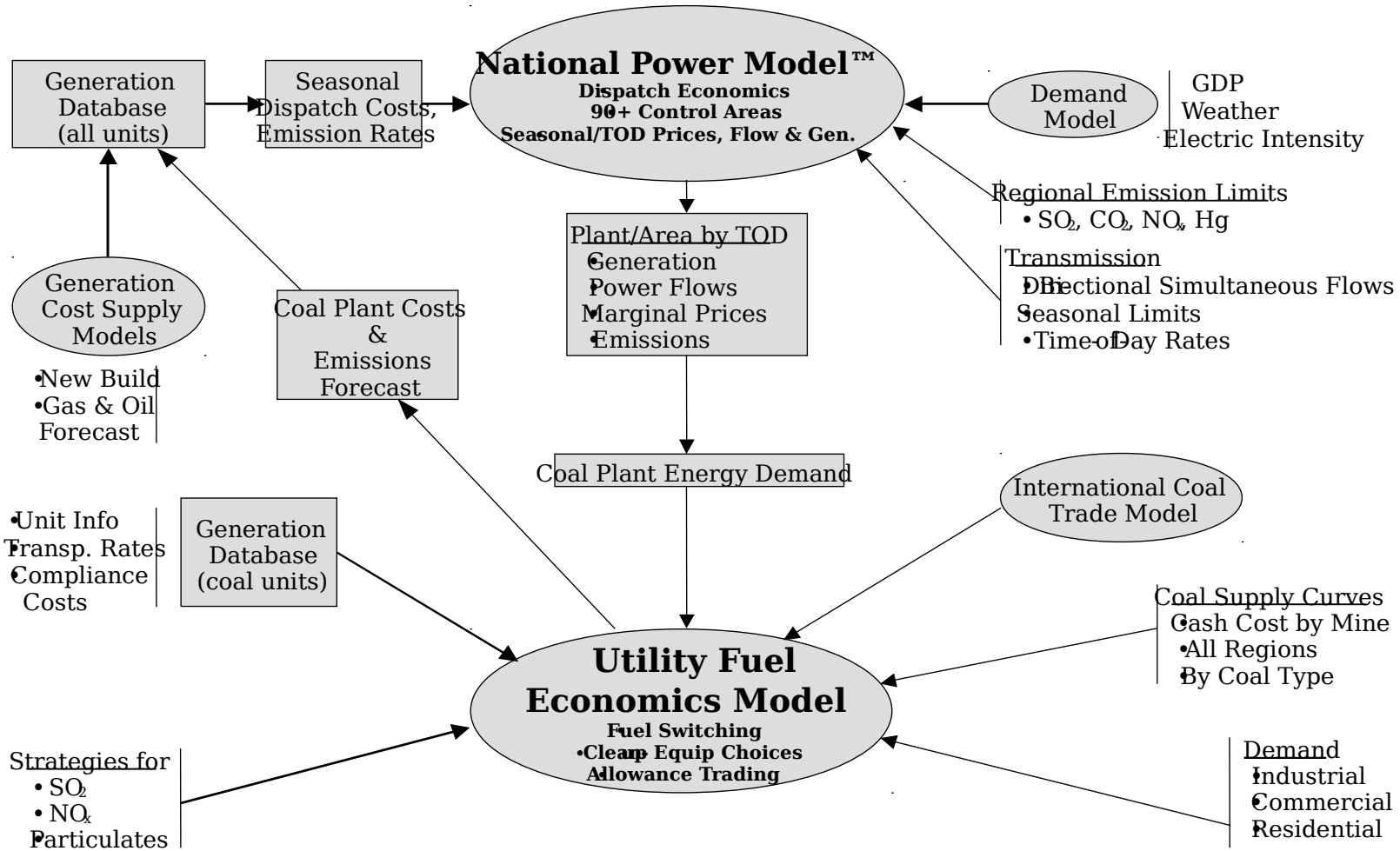
- Detailed accounting model
- Based upon utilities10-year forecasts
  - Generation by plant
  - Coal consumption, sourcing & mode of delivery – utilities environ assumption
  - Extrapolate from the 10 year forecast
- No ability to test environmental scenarios

Models - Hill & Associates

- Nationally recognized
  - EPA, Dept of Energy, utility companies
  - 15 years in development
  - Off-the-shelf for reasonable price
- Incorporates international trade
- Ability to handle myriad of scenarios, including environmental policies

Hill Model - Control Areas

Hill and Associates, Inc.
Electric Generation, Coal and Emissions Forecasting System



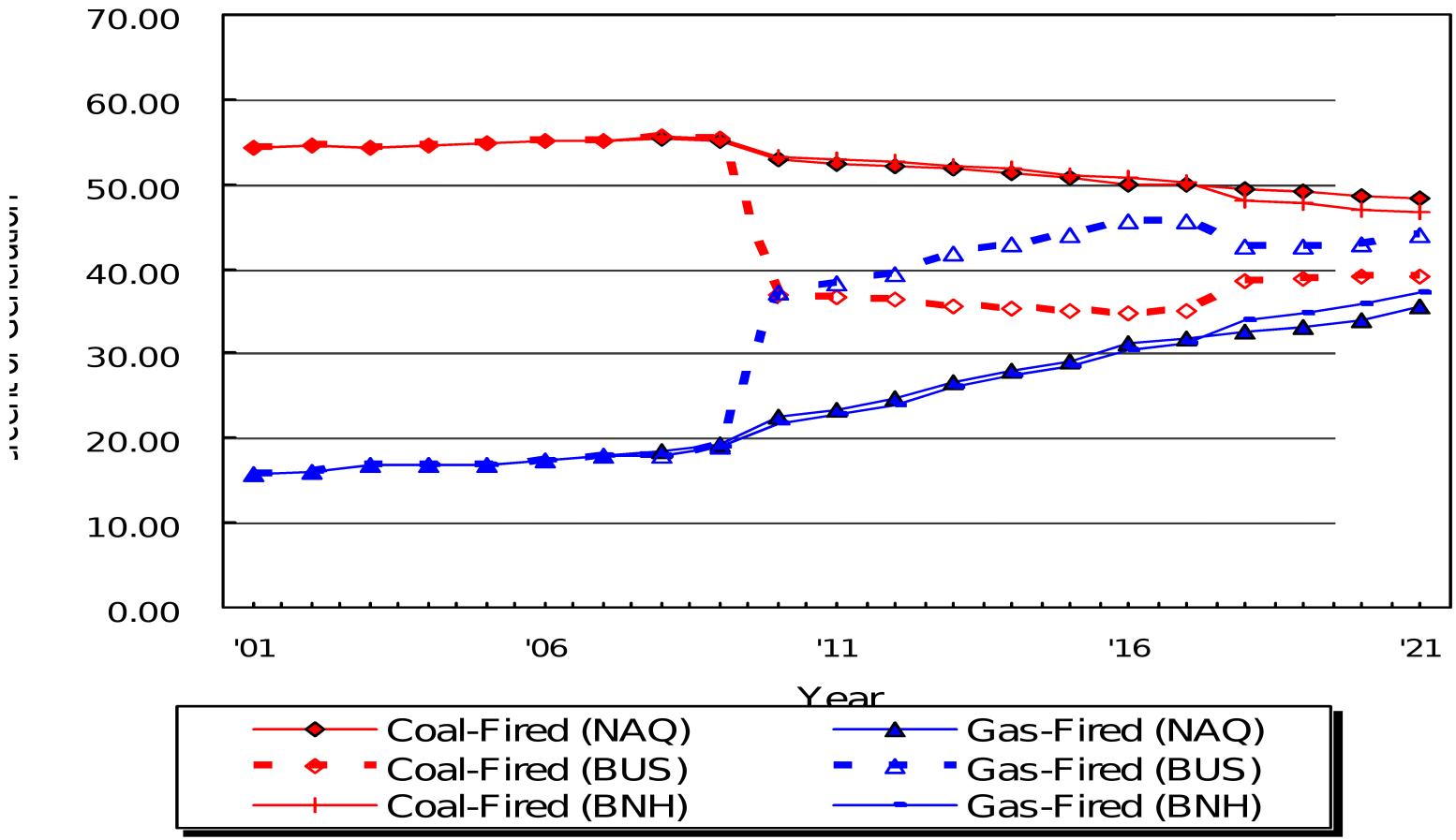
Hill Model - Environmental Scenarios

- NAQ – National Ambient Air Quality Standards
  - Limits NOx & SO2 by 2010
- BUS – Bush Clear Skies
  - Limits NOx & SO2, but sooner and limits lower than current under NAAQS
  - Limits Mercury
- BNH – Modified Clear Skies
  - Same as BUS, but less restrictive Mercury

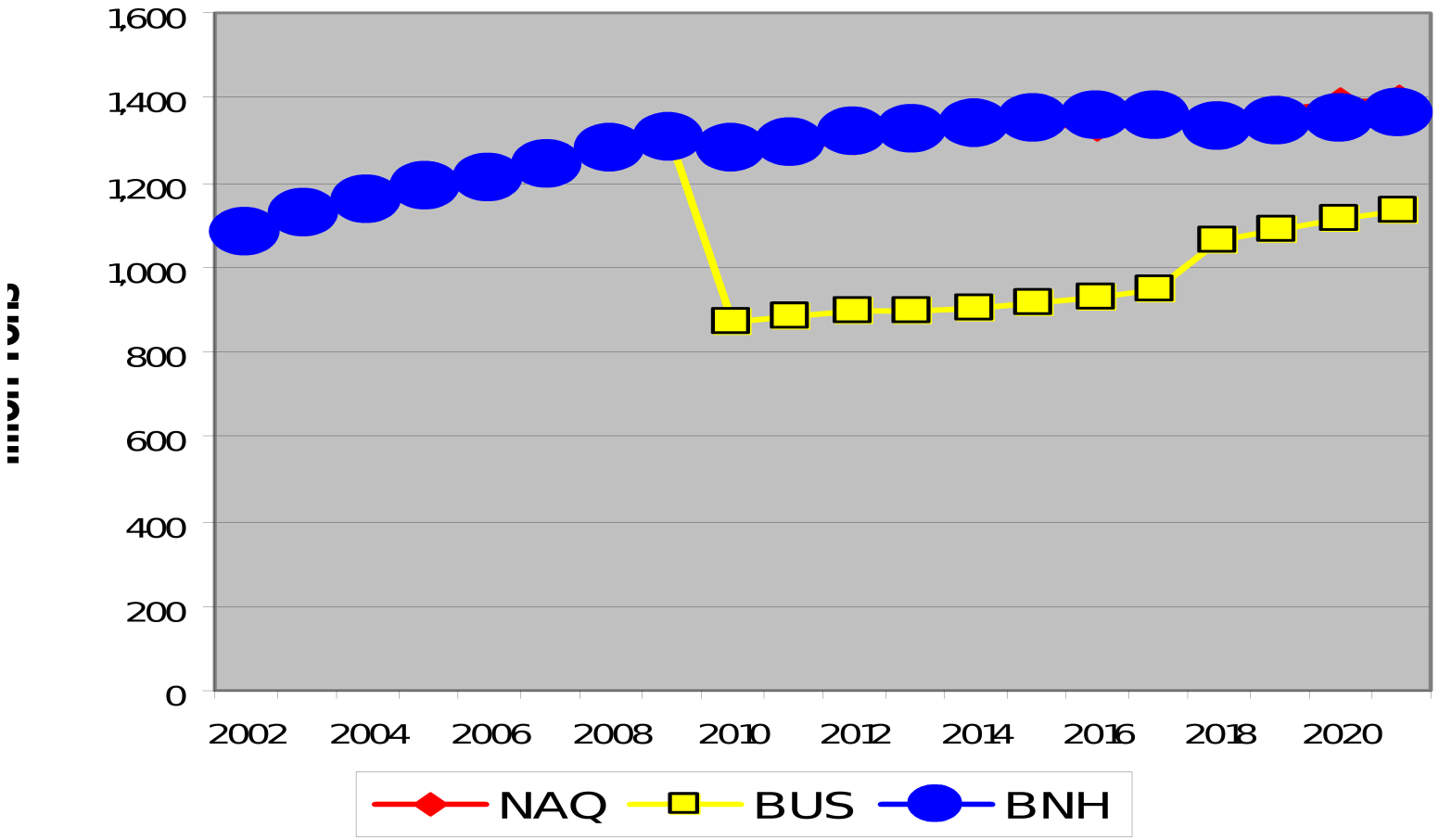
Hill Model - Results

- Coal's share of generation declines; however, use increases, except under under Clear Skies
- Use of natural gas increases – dramatic under Clear Skies
- Use of central Appalachian coals declines – all scenarios
- Use of higher sulfur coals increases – all scenarios

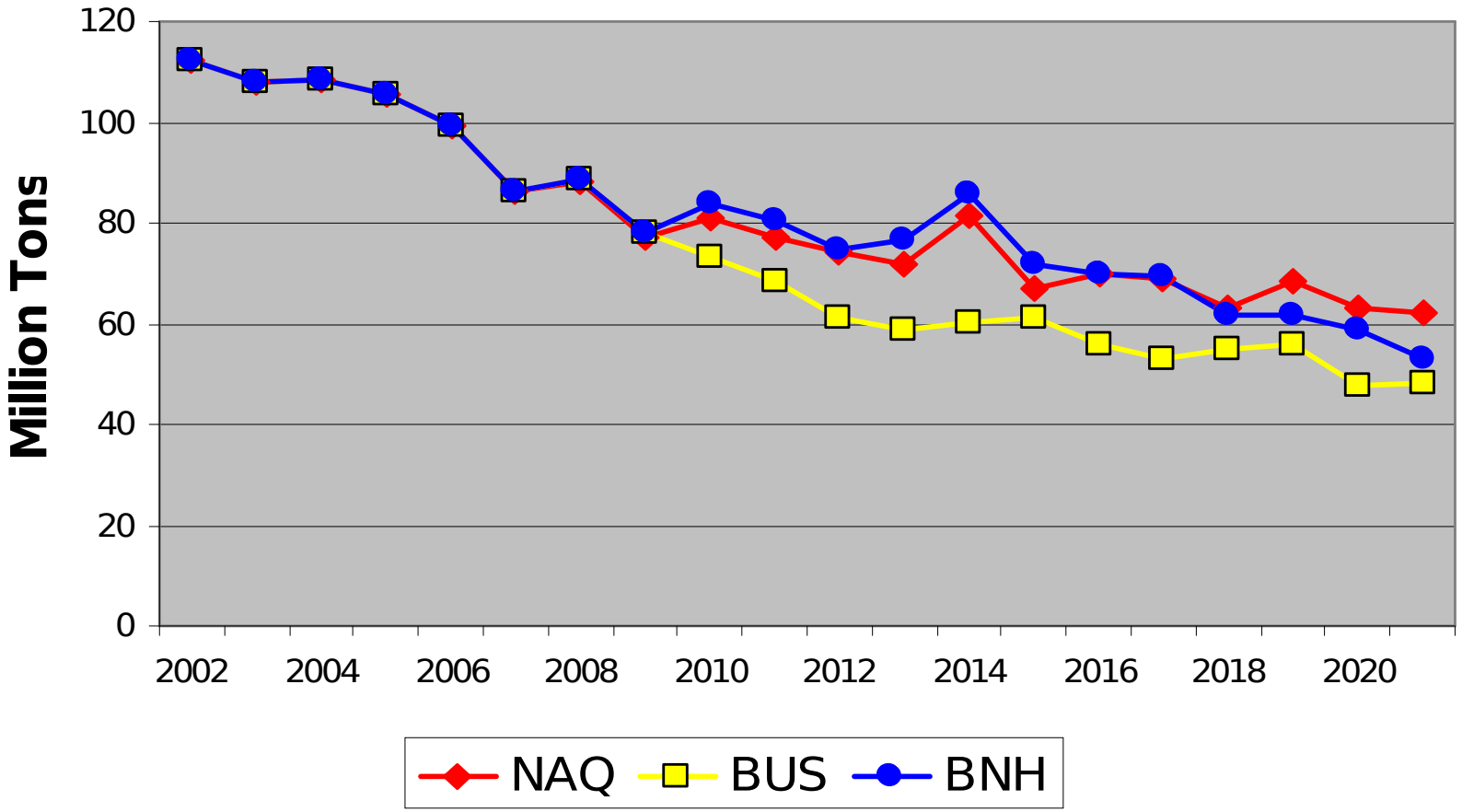
Fuel Shares of Generation
(NAQ Case, BUS Case, BNH Case)



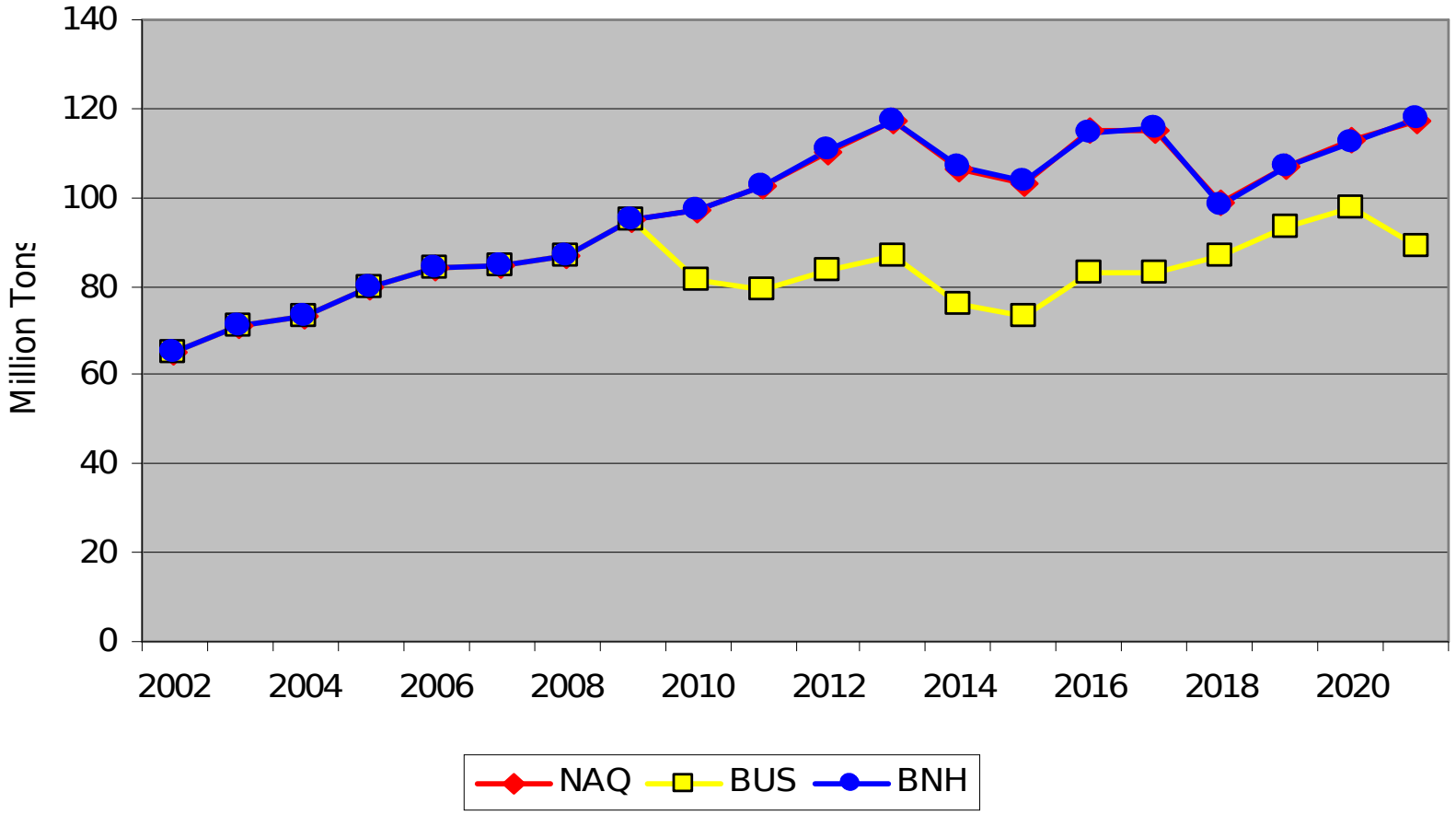
Total U.S. Steam Coal Production



Cent. App. Near Compliance Coal Production



N. App. Mid-Sulfur Coal Production



Hill Model - Ohio Basin Sub-Model

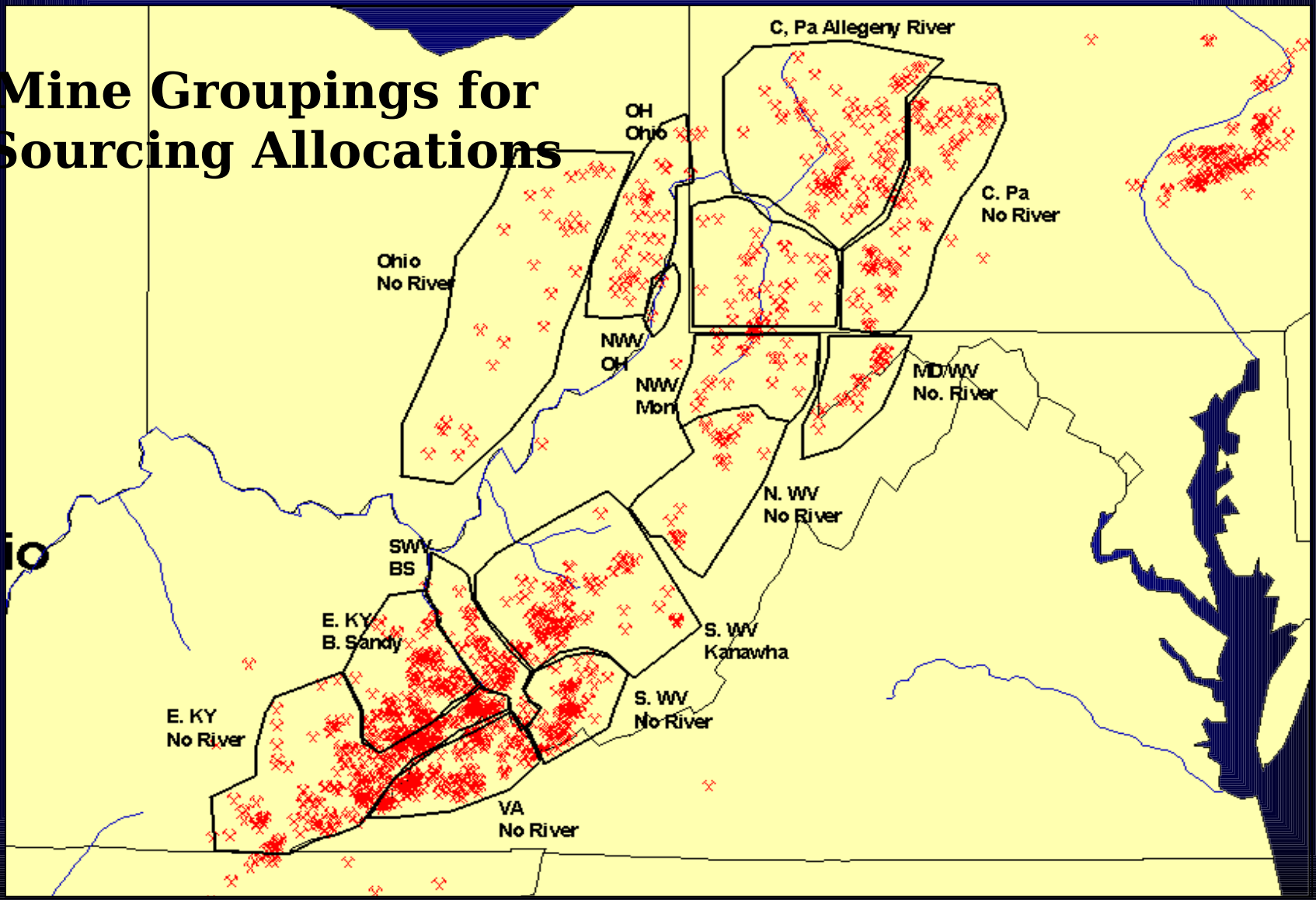
Hill Model – off-the-shelf generates for each scenario:

1. Coal plant generation
2. Coal plant consumption
3. Source of coal consumed by each plant

Ohio Basin sub-model generates for each scenario:

1. Mode used to deliver coal to plant
2. For water moves, map the Coal Types to Closest/Likely River Access

Mine Groupings for Sourcing Allocations



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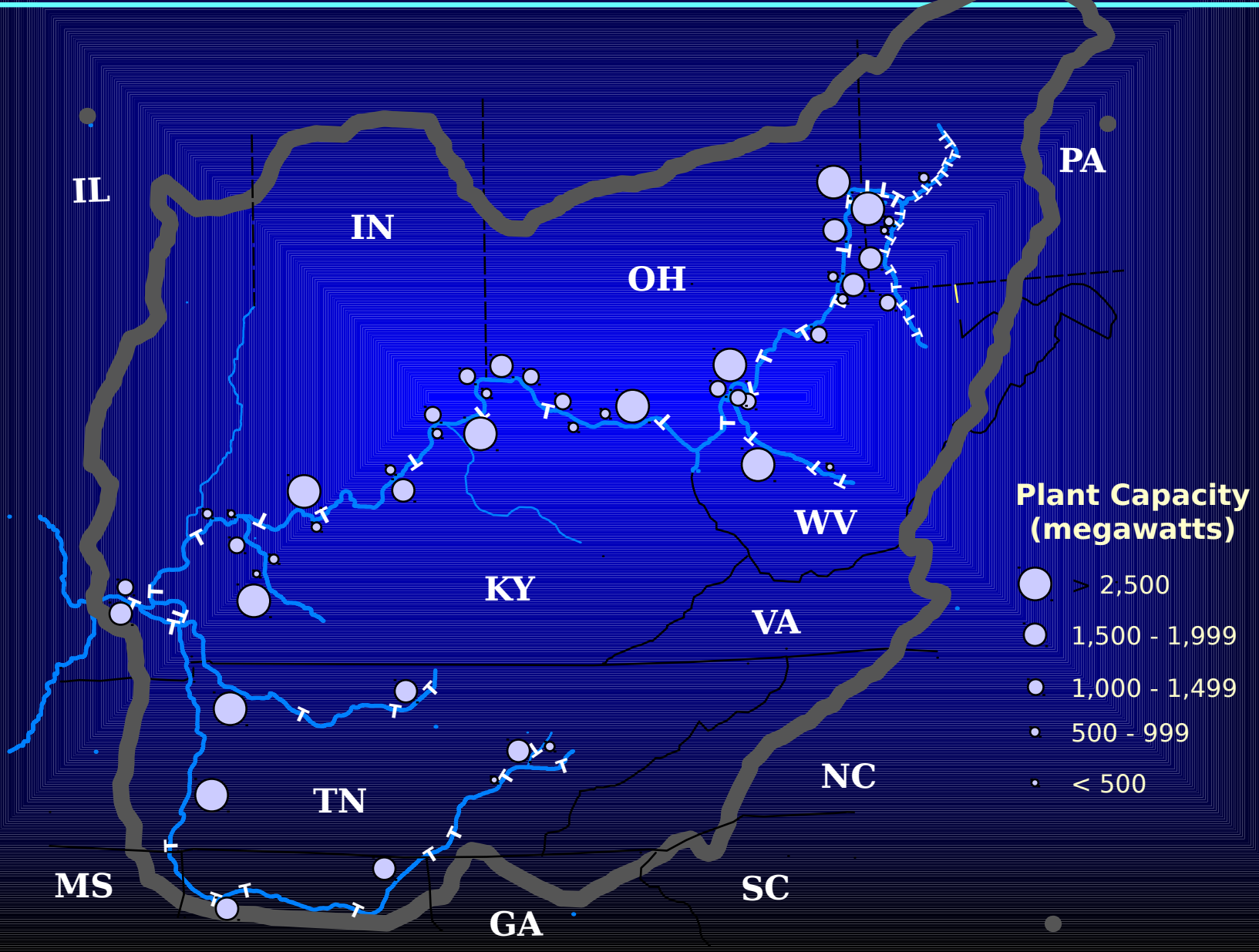

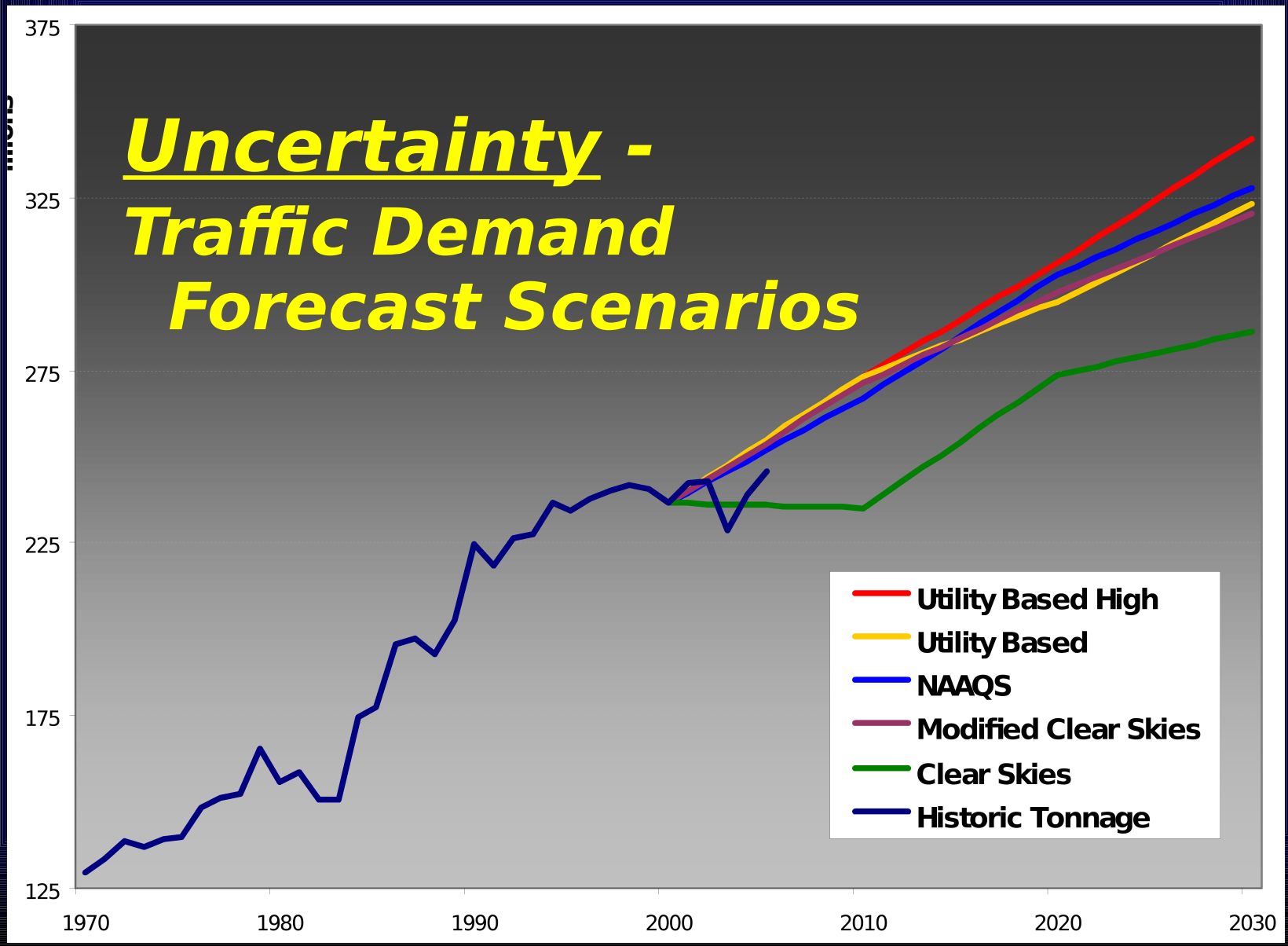
Uncertainty -
Traffic Demand
Forecast Scenarios
375
325
275
225
175
125
1970
1980
1990
2000
2010
2020
2030
Utility Based High
Utility Based
NAAQS
Modified Clear Skies
Clear Skies
Historic Tonnage

Conclusions - ITR

Anticipated the peer review process by assembling external review Team

- Economics Appendix, Lead - John Burns
- Four Others Reviewed Other Components
- Traffic Demand Projections - Steve Fuller, Texas A&M (NAS member)
- Additional Review by Published TRB Paper – see http://inlandwaterways.lrh.usace.army.mil/

Conclusions - Key Takeaways

- Empirically-driven, spatially-detailed
  - Need lots of data, much not on shelf
  - Development costs very high
  - Maintenance costs high
- Hill is powerful tool for describing uncertainty and testing sensitivities
  - Fuel prices
  - New technologies
  - New policies (de-reg, environmental)

Conclusions - What's next?

- Hill model
  - Refine the transportation module
  - Develop feedback loop between Hill Model & waterway system model
- System modeling
  - Continue development for other industries
    - Grain – NETS
    - Coal
    - Iron & steel
    - Petroleum
    - Containers??
    - Others??
  - Freight demand, modes, and waterway